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Subject: Biological Evaluation of Spruce Beetle in Mill Hollow, Heber RD, Uinta NF--1981

To: Chief

Enclosed is an evaluation conducted in Mill Hollow east of Heber, Utah, on the Uinta National Forest. The evaluation provides management recommendations for minimizing tree losses to spruce beetle on the north-facing slope of Mill Hollow. Basic information on stocking, basal area, and volume losses in the timber stands are provided to support the development of timber harvest plans for Mill Hollow and adjacent stands.

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Enclosure

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FOREST PEST MANAGEMENT

STATE & PRIVATE FORESTRY

INTERMOUNTAIN REGION

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BIOLOGICAL EVALUATION OF SPRUCE BEETLE IN MILL HOLLOW, HEBER RD, UINTA NF -- 1981

By
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INTRODUCTION

The spruce beetle, Dendroctonus rufipennis (Kirby), kills mature Engelmann spruce in the spruce-fir, Picea engelmannii Parry and Abies lasiocarpa (Hooker) Nutt., type in the Central Rockies. Since the late 1800's, populations of this bark beetle have periodically reached outbreak proportions and killed thousands of spruce. The known outbreaks have originated from windthrown trees, or residuals from cutting operations (Wygant and Lejeune 1967) which create a habitat extremly conducive to brood development.

In 1981, fading spruce trees were observed on the north facing slope adjacent to Mill Hollow Campground on the Heber Ranger District, Uinta NF (Fig. 1). On June 9, 1981 a preliminary investigation of the area indicated approximately 500 acres of overmature spruce were infested with spruce beetle (3400 Letter dated June 12, 1981).

The last reported spruce beetle outbreak on the Uinta NF was in 1958 when beetle infestations were reported extending from Wolf Creek through Soapstone Basin and included Mill and Shingle Hollows (Washburn and Knopf 1959). This outbreak was effectively managed through the immediate implementation of silvicultural and chemical techniques. The present outbreak began in 1978 resulting from a pocket of windthrown spruce adjacent to the Mill Hollow Campground. The area was promptly logged to remove infested trees, however large residual butt logs and high stumps remaining after the logging operation provided sites for further population development.

The purpose of this evaluation is to (1) describe the current situation including tree losses; (2) discuss projected losses in the future; and, (3) provide recommendations for minimizing future losses to the spruce beetle.

TECHNICAL INFORMATION

Insect.--Spruce beetle, Dendroctonus rufipennis (Kirby)

Host.--Engelmann spruce, Picea engelmannii Parry

Life History and Evidence of Infestation (Furniss & Carolin 1977).--
The spruce beetle generally has a 2-year life cycle. The adult attacks weakened or wind-thrown trees in the spring. Eggs hatch and larvae develop in the summer. They overwinter as half to nearly full-grown larvae and complete development the following year. New adults emerge in August and migrate to the base of the trees to overwinter.

Outbreaks are difficult to detect because the trees do not fade until three years after attack. The second year after attack, needles turn a pale green before falling off the tree. Pitch tubes are not always present; as a result, first-year attacks are sometimes only detected by the presence of brown boring dust around the base of the tree. The evidence of woodpecker activity is also an indication of attack.

During endemic years, the spruce beetle primarily attacks wind-thrown or weakened trees and stumps. Outbreaks are often caused by beetle populations building up in wind-thrown trees or logging debris, and spreading to standing trees. They will attack standing trees of all sizes, but prefer the large, overmature trees.

Methods

The infested spruce-fir type adjacent to Mill Hollow Campground was evaluated systematically, using a variable plot method. Variable radius plots (BAF 20) were established every 2.5 chains along 30-chain transects spaced 5 chains apart. Data on all trees were collected at every fifth plot (volume plots). At the other plots (count plots) data were collected on beetle-attacked and diseased trees with only a basal area count of other trees on the plot.

All trees within each plot were examined and the following information was recorded: tree species, DBH, total height in feet, general condition (live or dead) and presence of insect or disease infestation. Two roots on opposite sides of each dead or symptomatic tree were excavated and examined for evidence of root disease. Tree boles were examined for signs and symptoms of heartrot, including conks and large wounds. Bark was removed to expose beetle galleries for determining the year of attack.

Fixed-area plots (0.01 acre) were established at each volume plot to measure the amount of regeneration. All trees greater than 6 inches tall and less than 4.9 inches DBH were recorded.

Results and Discussion

Species Distribution. Englemann spruce comprises 57 percent of the stand with subalpine fir (24%) and Douglas-fir (19%) comprising the remainder of the species distribution (Table 1). Subalpine fir (avg. 12" DBH) occupied the lower DBH classes, (Table 2), and spruce (avg. 20" DBH) and Douglas-fir (avg. 20" DBH) were in the larger DBH classes (Tables 3 and 4).

Subalpine fir is regenerating the most successfully with 1950 seedlings per acre and 710 saplings per acre. Spruce is regenerating with 30 seedlings per acre and 120 saplings per acre. Douglas-fir regeneration was not present in the sampled areas (Table 5).

Spruce Beetle and Disease Levels. Spruce beetle attacks were detected on 7 percent of the Engelmann spruce. The beetle-attacked spruce were primarily in the 18 inches and over DBH classes accounting for 317 cu. ft. or 7 percent of the volume. A total of 13 spruce trees, 10 faders and 3 dead, were attacked by the beetle. Spruce broom rust, Chrysomyxa archtostaphyli Diet., was found in 1 spruce accounting for 1 percent of the volume.

Subalpine fir was infected with broom rust, Melampsorella caryophyllacearum Schroet., and Fomes annosus and Armillaria mellea root rots. These diseases affected trees ranging from 8 inches to 18 inches DBH. Total volume affected was 209.6 cubic feet or 18 percent of the subalpine fir volume. Heart rot also infected the Douglas-fir affecting 2 percent of the volume.

Stand data describes an overmature forest of spruce and Douglas-fir regenerating to subalpine fir. The stand has the necessary attributes for high susceptibility to spruce beetle attack. Highly susceptible stands are characterized by an average DBH of greater than 16 inches, basal area over 150 sq. ft., and 50% or greater spruce in the canopy. The Mill Hollow area has an average DBH of 20 inches with 210 sq. ft. of basal area and 57 percent of the canopy is spruce. Windthrow occurring on the west end of the campground in 1978 provided the brood material to initiate an outbreak. Subsequent efforts to log the infested material were not entirely successful and beetle populations have infested some of the large diameter spruce on the adjacent north-facing slope. Current stand conditions will continue to support spruce beetle activity until most of the large diameter overmature trees are removed and the basal area reduced below 150 sq. ft.

Although the incidence of root rot in subalpine fir is fairly high (18%), this species will become the predominant species as the spruce is removed by the beetle. Subalpine fir seedlings and saplings comprise 95 percent of the regeneration. Regenerating the stand to subalpine fir will accelerate the incidence of root rot in this species. Douglas-fir occurred only in isolated pockets and no regeneration was present.

The current spruce beetle infestation in Mill Hollow will continue to cause significant spruce mortality as indicated by the susceptibility of the stands examined. If spruce is the desired species to be managed in this area, action needs to be taken immediately to minimize potential losses from spruce beetle.

The attacks in 1978 were visible in 1981, and the newly infested trees in 1981 will be visible as faders in another 3 years. Because the visible symptoms of an outbreak are not readily apparent each year, the rapid population build-up of the beetle is many times not noticed until extensive mortality occurs. Mill Hollow and the surrounding drainages are currently infested and highly susceptible to a rapid increase in beetle populations with subsequent mortality. To avoid additional spruce mortality from spruce beetle, stands need to be managed to reduce basal areas and increase vigor in the remaining trees.

ALTERNATIVES

The following alternatives for managing a spruce beetle infestation are available:

1. No action. This alternative would allow the infestation to continue and accept the losses incurred until the infestation collapses naturally.

2. Direct suppression. This alternative would involve individual tree treatment. This treatment could be through removal of infested trees, treating them with a chemical insecticide, or by felling and burning. Individual tree treatment is often expensive and effective only in small infestations. Chemically treated trees could be salvaged at a later date.

3. Sanitation logging. In this alternative, susceptible green trees would be removed from the stand on a selective basis. This would remove the large diameter trees and reduce the basal area of the stand by changing the green stand structure. This alternative would not be effective by itself in an already infested stand; however, sanitation logging could be used to reduce the susceptibility of an uninfested stand.

4. Salvage logging. Both currently infested trees and dead trees would be removed. This alternative would utilize the timber resource, as well as suppress the infestations. However, in large areas of infestation, this action may not be practical. This type of logging would not change factors in the stand causing the outbreak.

5. Sanitation/salvage logging. This alternative combines the removal of dead and infested trees, and the susceptible uninfested trees in a stand. This would allow utilization of the timber resource and change the stand structure to reduce the susceptibility of the stand. In extensive areas of infestations, this alternative may not be practical.

6. Trap-tree method. Attempts have been made to use trap trees as a means of beetle control. This involves felling uninfested green trees around an infestation. The beetles will attack available down material. In large infestations, this method may not control a population, but it would remove beetles that might otherwise attack other standing trees. Large, merchantable trees would be cut in the fall or in the spring before beetle flight. Trees should be felled in shaded area, but not on moist sites where they will sink into any mud; the limbs should be left uncut. Once the trap trees have been attacked, they should be removed from the stand within 1 year of date of felling. Trap trees should be cut within 1/4 mile of an accessible road.

A variation of the trap trees is the lethal trap tree which incorporates the use of cacodylic acid. Trap trees are treated with cacodylic acid, then cut. The cacodylic acid provides an unfavorable environment for the brood and they die before completing development. This method would not require the removal of trap trees within a certain time period.

RECOMMENDATIONS

Short-term Action. From an entomological standpoint, there is little that can be done to suppress the entire infestation. This is because of the extent of the infestations and the susceptibility of the remaining uninfested stands. The inaccessibility of some areas also limits the actions that can be taken against the infestation.

Recommended actions are as follows:

1. The extent of the infestation, as well as economic and physical constraints, would not allow effective treatment of the entire infestation, therefore; the infested areas should be prioritized according to value and management objectives in order to effectively utilize the available resources.

2. The sanitation/salvage alternative is recommended for Mill Hollow. This would involve a one-time entry into the stands to remove infested and susceptible, uninfested trees without affecting the windfirmness of the stand and conform to stand prescriptions.

3. A no action alternative is recommended for areas of low priority, where management objectives, economics, or accessibility do not permit a suppression program. Losses from the spruce beetle will have to be accepted with this alternative.

4. In some situations, for instance where a sanitation/salvage program is planned, trap trees could be felled within the infestation area. Trap trees would not suppress the infestation, but would attract many beetles that might otherwise attack standing green trees. Trees should be felled in areas that are accessible, since it would be essential that they be removed within 1 year of the date of felling.

Trees cut for road rights-of-way or other logging activity or windthrow in infested areas can be left for trap trees for 1 year. If these trees occur in areas where no infested trees area nearby, they must be removed as they will only serve to draw beetles into a previously uninfested area.

Long-term Action. The potential for future spruce beetle infestations can be reduced by modifying management of spruce-fir stands. Hazard rating should be done to determine the susceptibility of uninfested stands and priorities established on the stands. Managing these stands would involve sanitation logging to convert stands to a less susceptible condition by removing large diameter, overmature trees and reducing the basal area of the stand. Thereafter, group selection and/or patch, strip, or stand clearcutting should be conducted to maintain this stand condition. If blowndown occurs, the infested material should be removed promptly.

To prevent population buildups and subsequent outbreaks in all harvesting and cutting operations, including normal timber harvest or spruce, sanitation/salvage cutting, or cutting for road rights-of-way and construction, all slash and butt logs should be treated in a proper manner.

LITERATURE CITED

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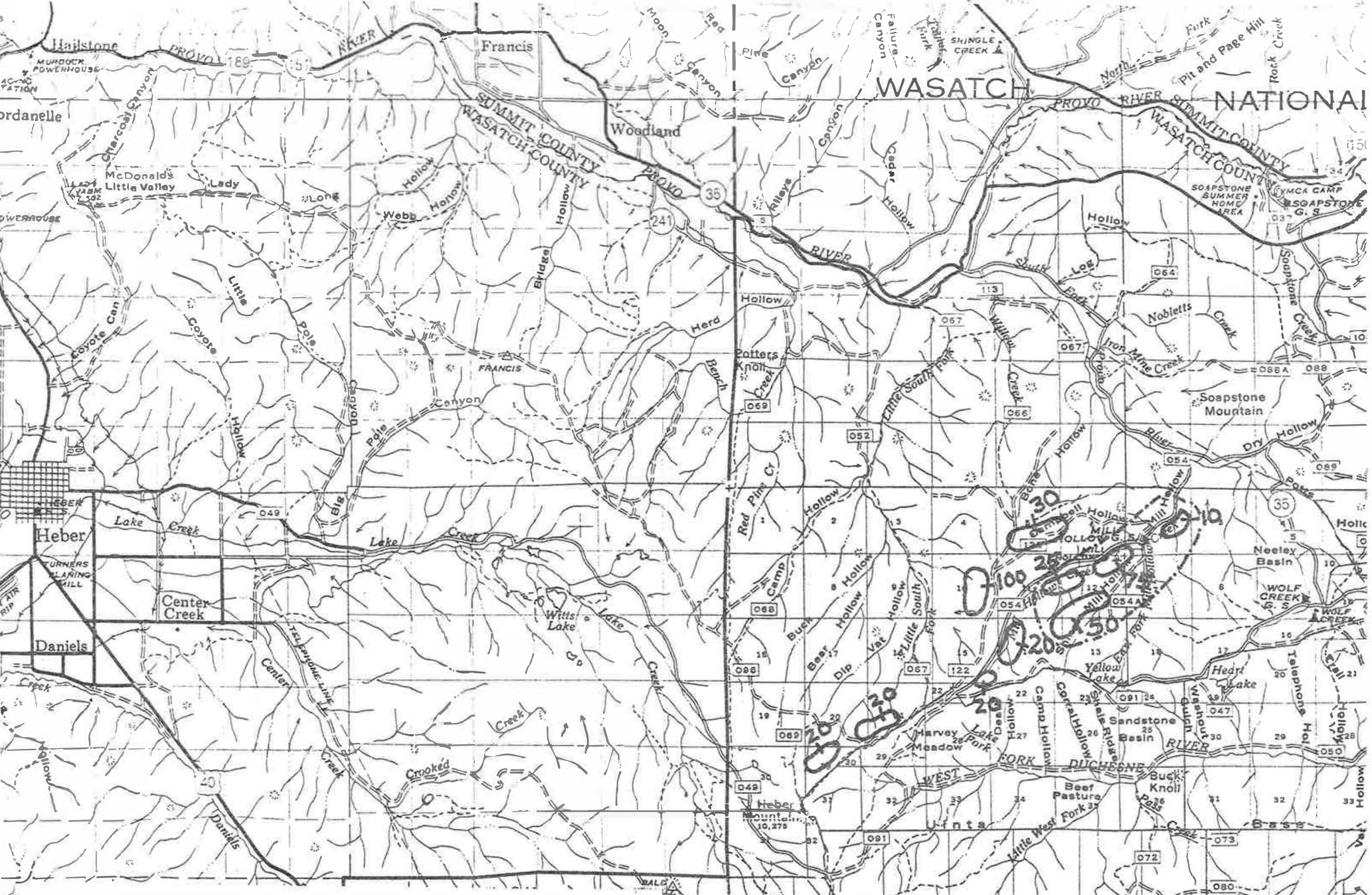

Figure 1. 1981 Engelmann Spruce Beetle Survey
Heber District - Uinta National Forest

O Spruce mortality areas mapped during 1981 aerial survey showing number of faders

Survey area

Table 1. Survey data for trees by species and condition for Mill Hollow, Uinta National Forest - 1981.

SPECIES	LIVE			FADERS			DISEASED			DEAD			TOTAL OF ALL CLASSES		
	CF/A[a]	S/A[b]	BA/A[c]	CF/A	S/A	BA/A	CF/A	S/A	BA/A	CF/A	S/A	BA/A	CF/A	S/A	BA/A
Engelmann spruce	4304.5	60.6	112.8	239.2	3.0	5.6	27.6	0.2	.6	77.5	1.2	1.7	4648.8	65.0	120.7
Subalpine fir	929.7	79.6	42.2	0	0	0	101.4	6.4	3.9	108.2	7.0	3.9	1139.3	93.0	50.0
Douglas-fir	1597.9	26.9	38.3	0	0	0	36.7	1.1	1.1	0	0	0	1634.6	28.0	39.4
Total	6832.1	167.1	193.3	239.2	3.0	5.6	165.7	7.7	5.6	185.7	8.2	5.6	7422.7	186.0	210.1

[a] Cubic Feet (volume) per acre.

[b] Stems per acre.

[c] Basal Area (sq. ft.) per acre.

Table 2. Mean stems per acre (S/A) and cubic foot volume per acre (CF/A) of subalpine fir by diameter class and tree condition.

Diameter Class (in.)	Height (ft.)	LIVE		INFECTED		DEAD	
		CF/A	S/A	CF/A	S/A	CF/A	S/A
6	45	149.9	34.0	0	0	12.5	2.8
8	52	108.0	14.3	36.0	4.8	0	0
10	69	215.1	15.3	0	0	28.7	2.0
12	85	253.1	10.6	0	0	33.7	1.4
14	85	149.4	4.7	16.6	0.5	0	0
16	80	0	0	31.0	0.8	15.5	0.4
18	93	0	0	17.8	0.3	17.8	0.3
20	95	54.2	0.8	0	0	0	0
Total all Classes		929.7 (82%)	79.6 (86%)	101.4 (9%)	6.4 (1%)	108.2 (9%)	7.0 (8%)

Table 3. Mean stems per acre (S/A) and cubic foot volume per acre (CF/A) of Engelmann spruce by diameter class and tree condition.

Diameter Class (in.)	Height (ft.)	LIVE		FADERS		INFECTED		DEAD	
		CF/A	S/A	CF/A	S/A	CF/A	S/A	CF/A	S/A
6	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
10	78	52.5	3.1	17.5	1.0	0	0	0	0
12	105	487.8	14.9	0	0	0	0	23.2	0.7
14	115	607.6	12.5	0	0	0	0	0	0
16	119	392.0	6.0	52.3	0.8	0	0	0	0
18	108	568.5	7.5	23.7	0.3	0	0	0	0
20	122	881.6	8.4	26.7	0.3	0	0	26.7	0.3
22	133	496.5	3.8	0	0	27.6	0.2	27.6	0.2
24	108	135.1	1.1	45.0	0.4	0	0	0	0
26	121	218.8	1.4	0	0	0	0	0	0
28	126	297.7	1.6	24.8	0.1	0	0	0	0
30	160	91.5	0.3	0	0	0	0	0	0
32	120	0	0	23.2	0.1	0	0	0	0
34	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
38	133	74.7	0.2	0	0	0	0	0	0
40	140	0	0	26.0	0.1	0	0	0	0
Total all Classes		4304.5 (93%)	60.6 (93%)	239.2 (5%)	3.0 (5%)	27.6 (1%)	0.2 (1%)	77.5 (2%)	1.2 (2%)

Table 4. Mean stems per acre (S/A) and cubic foot volume per acre (CF/A) of Douglas-fir by diameter class and tree condition.

Diameter Class (in.)	Height (ft.)	LIVE		INFECTED		DEAD	
		CF/A	S/A	CF/A	S/A	CF/A	S/A
6	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
10	85	47.6	3.1	15.9	1.0	0	0
12	80	44.4	2.1	0	0	0	0
14	98	108.0	3.1	0	0	0	0
16	110	482.9	9.5	0	0	0	0
18	111	182.4	2.8	0	0	0	0
20	126	275.5	3.1	0	0	0	0
22	109	119.6	1.3	0	0	0	0
24	110	59.5	0.5	0	0	0	0
26	130	69.0	0.5	0	0	0	0
28	130	68.5	0.4	0	0	0	0
30	140	73.2	0.3	0	0	0	0
32	0	0	0	0	0	0	0
34	120	0	0	20.8	0.1	0	0
36	0	0	0	0	0	0	0
38	130	67.2	0.2	0	0	0	0
Total all Classes		1597.9 (98%)	26.9 (96%)	36.7 (2%)	1.1 (4%)	0	0

Table 5. Stems per acre of regeneration by species for Mill Hollow, Uinta National Forest.

SPECIES	SEEDLINGS [1/]	SAPLINGS [2/]
Engelmann spruce	30	120
Subalpine fir	1950	710
Douglas-fir	0	0
TOTAL	1980	830

[1/] All trees without measurable DBH (<.5") and over 6 inches height.

[2/] All trees 0.5" to 4.9".